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1/77

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 P01/7700 0.00-0308815.0

The Patent Office

16 APR 2003

Concept House  
 Cardiff Road  
 Newport  
 South Wales NP10 8QQ

1. Your reference

SEM/JDCG/61699/000

2. Patent application number

(The Patent Office will fill in this part)

0308815.0

3. Full name, address and postcode of the or of each applicant (*underline all surnames*)

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Patents ADP number (*if you know it*)

6708960001.

8281396001

If the applicant is a corporate body, give the country/state of its incorporation

4. Title of the invention

APPARATUS AND METHOD FOR OPERATING CURRENT DEPENDENT ELECTRONIC DEVICES

5. Name of your agent (*if you have one*)

BOULT WADE TENNANT

"Address for service" in the United Kingdom to which all correspondence should be sent (*including the postcode*)

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Patents ADP number (*if you know it*)

42001 ✓

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (*if you know it*) the or each application number

Country

Priority application number  
 (*if you know it*)

Date of filing  
 (*day/month/year*)

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application

Date of filing  
 (*day / month / year*)

8. Is a statement of inventorship and of right to grant of a patent required in support of this request?  
 (*Answer 'Yes' if:*

NO

a) any applicant named in part 3 is not an inventor, or  
 b) there is an inventor who is not named as an applicant

or

c) any named applicant is a corporate body.  
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Continuation sheets of this form

Description 6

Claim(s) 3

Abstract

Drawing(s) 1 *1*

10. If you are also filing any of the following, state how many against each item.

Priority documents

Translations of priority documents

Statement of inventorship and right to grant of a patent (Patents Form 7/77)

Request for preliminary examination and search (Patents Form 9/77) 1

Request for substantive examination (Patents Form 10/77) 1

Any other documents  
(Please specify)

11

I/We request the grant of a patent on the basis of this application.

Signature

Date

16 April 2003

12. Name and daytime telephone number of person to contact in the United Kingdom

John Gregory  
020 7430 7500

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APPARATUS AND METHOD FOR OPERATING CURRENT DEPENDENT  
ELECTRONIC DEVICES

The present invention relates to an apparatus  
5 and method for operating one or more electronic  
devices which require a constant given current. In  
particular, the invention concerns operating a  
number of current devices such as light emitting  
diodes (LEDs) mounted on conductive strip to provide  
10 an elongate lighting strip.

Such lighting strips are well-known for example  
to mark the way to emergency exits on aircraft.  
They comprise a plurality of LEDs mounted at  
15 intervals along a conductive strip encased in  
plastic. LEDs, in common with a number of other  
electrical devices, are current devices, that is  
they rely on a constant current to operate, rather  
than a constant voltage.  
20 The life and brightness of a LED can be maximised by  
accurately controlling the current.

Known lighting strips have a driver apparatus  
which is designed to operate a given number and a  
25 particular type of LED. If the driver is used on a  
strip having a different number of LEDs or a  
different type of LED, then the drive apparatus must  
be completely reset which is a time-consuming,  
awkward and inefficient process.  
30

The present invention provides an apparatus for  
operating one or more electronic devices requiring a  
given current, comprising a regulator device  
providing a voltage output, and a feedback loop  
35 having a reference device connected to the voltage

output and requiring the same current as the electronic devices, a measuring and conversion device operable to measure the current through the reference device and convert it to a voltage value  
5 and return it to the regulator device, wherein the regulator device is operable to adjust the output voltage in response to the voltage value until the measured current is equal to the given current required.

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In the present invention, use of a reference device of the same type as the electronic device that is to be operated allows the regulator automatically to adjusted to produce an absolute  
15 voltage of the appropriate level to drive the remaining devices. In this way, the apparatus is able to produce the correct voltage, automatically compensating for both short and long term drift, for any type and number of electronic devices being  
20 used.

Preferably, the measurement and conversion device consists of a resistor and a current monitor.

25

The electronic devices are typically light emitting diodes, mounted on a conductive strip having a plurality of conductive elements.

30

The electronic devices may be parallel connected devices which are polarity sensitive, and the regulator may be connected to a three phase bridge to operate the conductive elements in the strip, and a micro controller operable to control the sequence in which the LEDs on the strip are  
35 operated.

Preferably, the regulator comprises a steady state DC device.

5 In a further aspect, the invention also provides apparatus for emitting electromagnetic radiation (EMR) comprising a plurality of electronic devices operable to produce EMR when provided with a given current mounted on a conductive strip which is connected to an apparatus of the type described  
10 above.

15 The present invention also provides a method for operating one or more electronic devices requiring a given current, comprising the steps of providing a voltage output, supplying the voltage output to a reference device requiring the same current as the electronic devices, measuring the current in the reference device, converting the measured current to a voltage value and adjusting  
20 the voltage output in response to the voltage value until the measured current in the reference device is equal to the given current required by the electronic devices.

25 Preferably, the method involves initially providing a voltage output sufficient to produce a current lower than the given current and gradually increasing the voltage output until the given current is obtained in the reference device.  
30

35 The present invention will now be described in more detail, by way of example only, with reference to Figure 1, which is a circuit diagram of one embodiment of apparatus in accordance with the present invention.

The principal feature of the present invention is that an electronic device of the same type as those to be operated is incorporated into a feedback loop of the apparatus. As shown in Figure 1 a 5 regulator device 10 is connected to the electronic devices to be driven. The regulator 10 is preferably, but not exclusively, a steady state DC device for accuracy. In this example, the electronic devices are LEDs (not shown) mounted on 10 a conductive strip having three conductors 12. A three-phase bridge 14 is connected between the regulator device 10 and the conductors 12. The regulator 10 may also be connected to a micro controller 16, itself connected to the three-phase 15 bridge 14, for example to control the sequence of operation of the LEDs in the conductive strip.

The regulator 10 is also provided with a feedback loop. The voltage output from the 20 regulator 10 also passes through a current measuring device such as a resistor 18 and a reference LED 20 of the same type as those in the strip which are to be driven. The resistor 18 is also connected to a current monitor device 22. Together the resistor 25 18 and the current monitor 22 act to measure the current passing through the reference LED 20 and to convert it to a voltage. This is passed back to the regulator 10. Since the desired current for the LEDs in the conductive strip is known from the 30 outset and the reference LED 20 is of the same type as the LEDs to be operated, this feedback loop allows the voltage output from the regulator 10 to be adjusted to the appropriate level so that the desired current is achieved.

In operation, the regulator 10 will initially be set to produce a voltage output which is lower than that required to provide the desired current. The current through the reference LED 20 is then 5 measured as the voltage output is gradually increased until the desired current through the reference LED 20 is achieved. At this point, the voltage output from the regulator 10 will be at the right level to operate the LEDs in the lighting 10 strip in an optimum manner.

Another important feature of the lighting strip of the preferred embodiment of the present invention is that it is directly driven by a controlled 15 voltage source thus removing the requirement for resistors within the lighting strip itself. Removal of the resistors from the lighting strip reduces the capacity for the lighting strip to heat up and consequently reduces the power consumption of the 20 lighting strip.

Certain applications may also require minimisation of Electro Magnetic Compatibility (EMC) interference for use in particularly sensitive 25 environments. The present invention can significantly reduce such interference by providing a standing DC voltage just below the threshold level required to operate the LEDs and superimposing small pulses which raise the voltage above the threshold 30 in order to switch the LEDs on. The switching voltage is thus a fraction of the full operating voltage then and the electro magnetic interference can be significantly reduced. For optimum performance the voltage pulses can have soft edges.

It will be appreciated that a number of modifications and variations to the details described above can be made. For example, if the lighting strip includes LEDs of different colours, 5 the regulator 10 may be provided with separate feedback loops with a reference LED of each colour and the micro controller may be used to control which LEDs are to operate at a given time. In addition, it will be appreciated that the present 10 invention is not restricted to use with conductive strips having LEDs, or indeed to conductive strips having devices which emit visible light. The invention is equally applicable to use with devices producing other wavelengths in the electromagnetic 15 spectrum, whether producing visible light or not.

The invention provides a simple and efficient manner in which to operate current devices, which is easily adaptable to operating different types and 20 numbers of devices.

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CLAIMS

1. Apparatus for operating one or more electronic devices requiring a given current, comprising a 5 regulator device providing voltage output, and a feedback loop having a reference device connected to the voltage output and requiring the same current as the electronic devices, a measuring and conversion device operable to measure the current through the 10 reference device and convert it to a voltage value and return it to the regulator device, wherein the regulator device is operable to adjust the output voltage in response to the voltage value until the measured current is equal to the given current 15 required.

2. Apparatus as claimed in claim 1, wherein the measurement and conversion device comprises a 20 resistor and a current monitor.

3. Apparatus as claimed in claim 1 or claim 2, wherein the electronic devices comprises light emitting diodes mounted on a conductive strip having a plurality of conductive elements. 25

4. Apparatus as claimed in any preceding claim, wherein the electronic devices are parallel connected and polarity sensitive, and the regulator is connected to a three-phase bridge and a micro 30 controller operable to control the sequence in which the LEDs on the conductive strip are operated.

5. Apparatus as claimed in any of the preceding claim, wherein the regulator device comprises a 35 steady state DC device.

6. Apparatus for emitting electromagnetic radiation, comprising a plurality of electronic devices operable to emit electromagnetic radiation when provided with a given current mounted on a conductive strip and connected to apparatus as claimed in any claims 1 to 5.

7. A method for operating one or more electronic devices requiring a given current comprising the steps of providing a voltage output, supplying the voltage output to a reference device requiring the same current as the electronic devices measuring the current in the reference device, converting the measured current to a voltage value, and adjusting the voltage output in response to the voltage value until the measured current in the reference device is equal to the given current required by the electronic devices.

8. A method as claimed in claim 7, further comprising the step of initially providing a voltage output sufficient to provide a current lower than the given current and gradually increasing the voltage output until the measured current in the reference device is equal to the given current.

9. Apparatus for operating one or more electronic devices requiring a given current substantially as hereinbefore described and with reference to the accompanying drawing.

10. Apparatus for producing electromagnetic radiation substantially as hereinbefore described and with reference to the accompanying drawing.

11. A method for operating electronic devices  
requiring given current as substantially  
hereinbefore described and with reference to the  
accompanying drawing.

5

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: 424152: SEM: LWC: LONDOCS

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Fig. 1

